

P T U – Kadoorie
Course: Thermodynamics
Date: 23-3-2011



13
25

College of Engineering
First Exam.
Sec. Semester 2010-2011

Q1: In the following questions, select the correct answer from choices followed each question and put the answer in the answer sheet: (10 marks)

1- In the fuel cell

- a- Water analyzed to hydrogen and oxygen to produced electric power
b- Oxygen and hydrogen react to form water and produce electric power
c- Water analyzed to hydrogen and oxygen and consume electric power
d- Oxygen and hydrogen react to form water and consume electric power

2- In the SI system of units, the absolute temperature is measured in

- a- Kelvin b- Degree Celsius c- Rankine d- Fahrenheit

3- A temperature change $\Delta T(K) = 15$ K. It's change in $^{\circ}C$ is

- a- $\Delta T(^{\circ}C) = 15$ $^{\circ}C$ b- $\Delta T(^{\circ}C) = 288$ $^{\circ}C$ c- $\Delta T(^{\circ}C) = 258$ $^{\circ}C$ d- $\Delta T(^{\circ}C) = -15$ $^{\circ}C$

4- The pressure in a chamber is 24 kpa gauge, the absolute pressure is (take $P_0 = 100$ kpa) :

- a- 24 kpa b- 124 kpa c- 76 kpa d- 100 kpa

5- The turbine in the thermal power plant change :

- a- the electric power to mechanical energy b- the shaft power to electric energy
c- the thermal power to electric energy d- the pressure and thermal power to mechanical energy

6- The difference in height between the columns of a manometer is 100 mm with a fluid of density 900 kg/m^3 , the pressure difference between its two ends is

- a- 0.882 kpa b- 1.76 kpa c- 4.5 kpa d- 2.72 kpa

7- A 2-m^3 tank is filled with propane gas at room temperature $20^{\circ}C$ and pressure 100 kPa ,the mass in the tank is:

$R = 665.6$
 $V = 4.2517$

- a- 4.34 kg b- 53 kg c- 2.82 kg d- 3.618 kg

8- Two properties are dependent when the substance is at saturated state

- a- temperature and specific volume b- specific volume and pressure c- temperature and pressure
d- pressure and quality

9- Sublimation is defined as

- a- changing from solid phase to vapor phase directly b- changing from solid phase to liquid phase
c- changing from solid phase to another solid phase d- changing from liquid phase to vapor phase

10- One of the following is extensive property

- a- density b- specific volume c- mass of substance d- solidification temperature

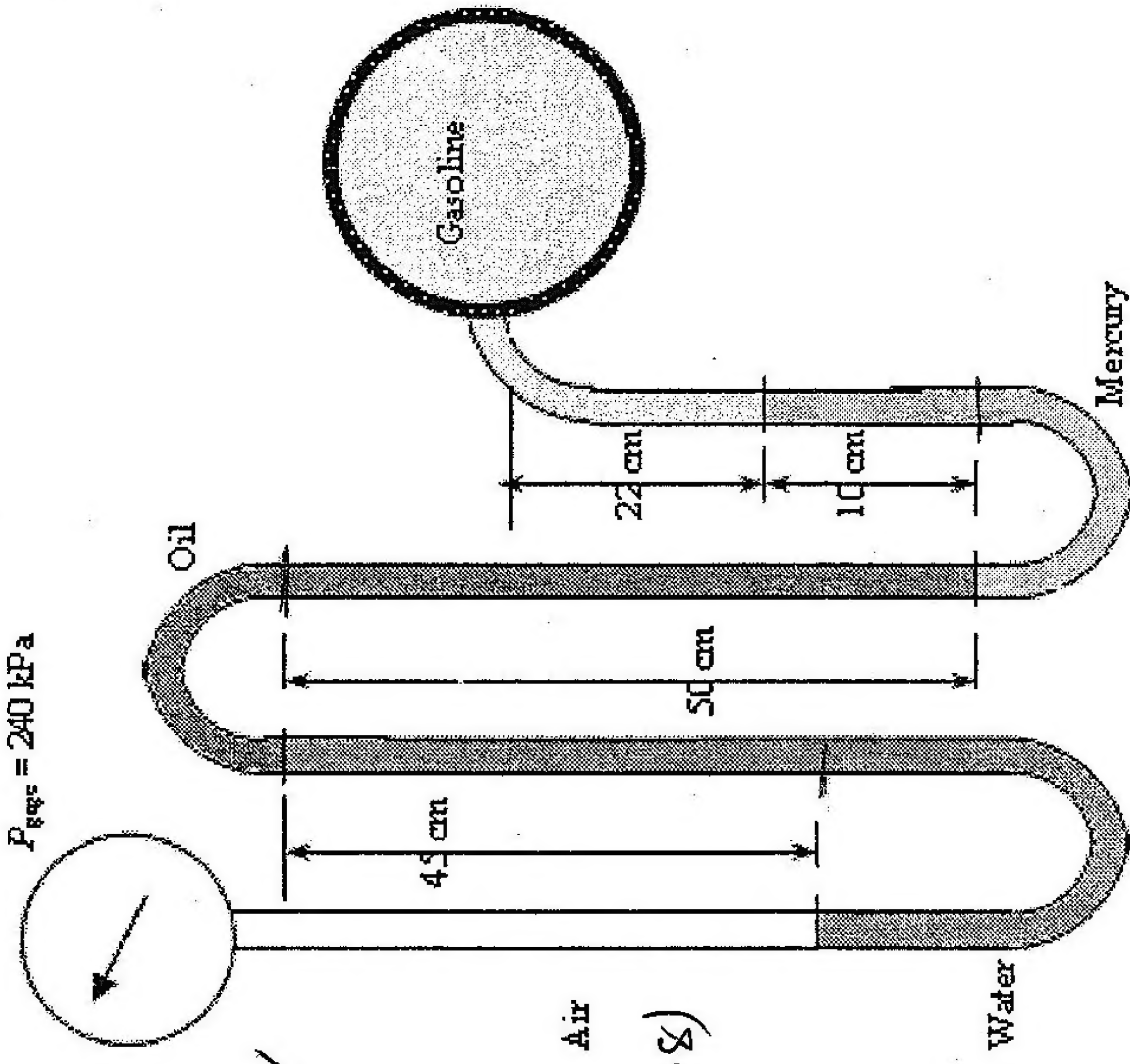
Q2: a- Complete the following table using thermodynamic tables:

(5 marks)

substance	Tem. ($^{\circ}C$)	Pressure (kpa)	Quality (x)	Specific. Volume (v)	Phase description
H ₂ O	180	1002.7	0.5125	0.10	Saturated mixture.
H ₂ O	250	1200	—	0.19235	Superheated Vapor water
R-22	-10	250	—	0.09528	superheated R-22
Ammonia NH ₃	15	800	—	0.183	Superheated Ammonia

1

Q3- A gasoline line is connected to a pressure gage through a double-U manometer. For a 240 Kpa of the pressure gage, the gage pressure of the gasoline line is to be determined
 $\rho_{oil} = 800 \text{ kg/m}^3$, $\rho_{water} = 1000 \text{ kg/m}^3$, $\rho_{mer} = 13600 \text{ kg/m}^3$, $\rho_{gas} = 700 \text{ kg/m}^3$, $g = 9.8 \text{ m/s}^2$.
 (5 marks)



$$P = 240 \text{ kPa}$$

$$P_2 = P_{\text{gage}} + \rho_{\text{water}} \times 0.45 \times 9.8 + \rho_{\text{oil}} \times 0.5 \times 9.8 + \rho_{\text{mer}} \times 0.1 \times 9.8 + \rho_{\text{gas}} \times 0.22 \times 9.8$$

$$P_2 = 240 - (1000 \times 0.45 \times 9.8) + (800 \times 0.5 \times 9.8) + (13600 \times 0.1 \times 9.8) + (700 \times 0.22 \times 9.8)$$

$$P_2 = 240 - 4410 + 3920 + 13328 + 1509.2$$

$$P_2 = \frac{23407.2}{1000}$$

$$P_2 = 23.4072 \text{ kPa}$$

Q4- A piston/cylinder arrangement, shown, contains air at 250 kPa, 300°C. The 50-kg piston has a diameter of 0.1 m and initially pushes against the stops. The atmosphere is at 100 kPa and 20°C. The cylinder now cools as heat is transferred to the ambient.

- At what temperature does the piston begin to move down?
- How far has the piston dropped when the temperature reaches ambient?

Assuming air is an ideal gas

(5 marks)

$$P = 250 \text{ kPa}$$

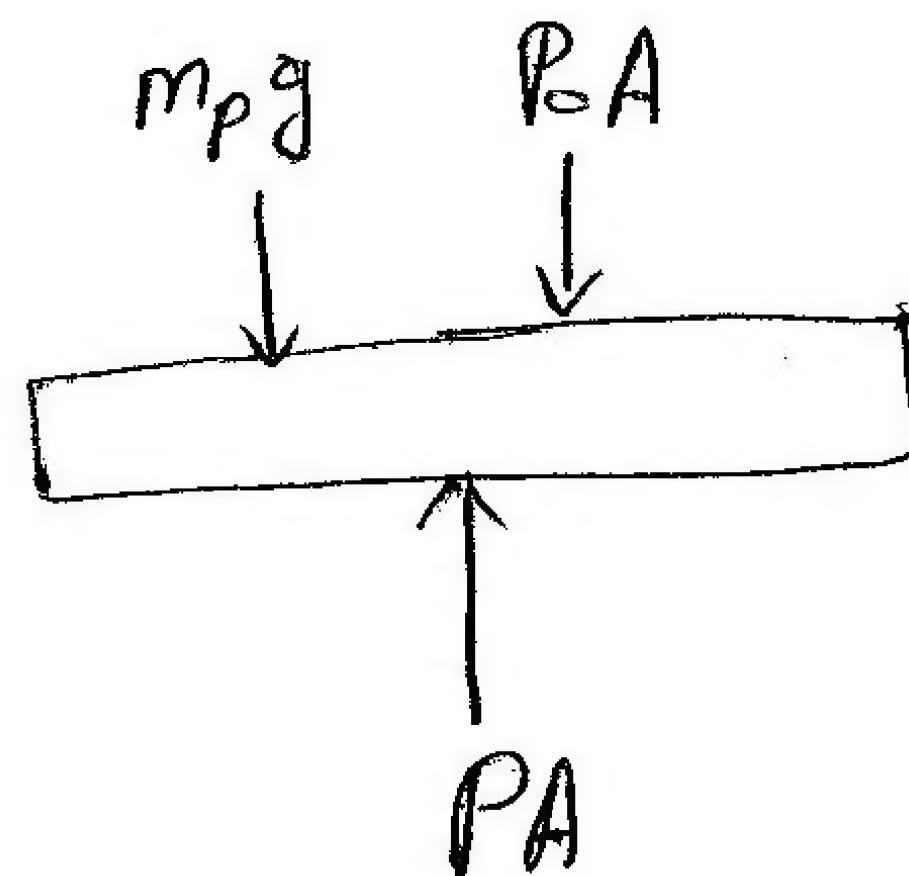
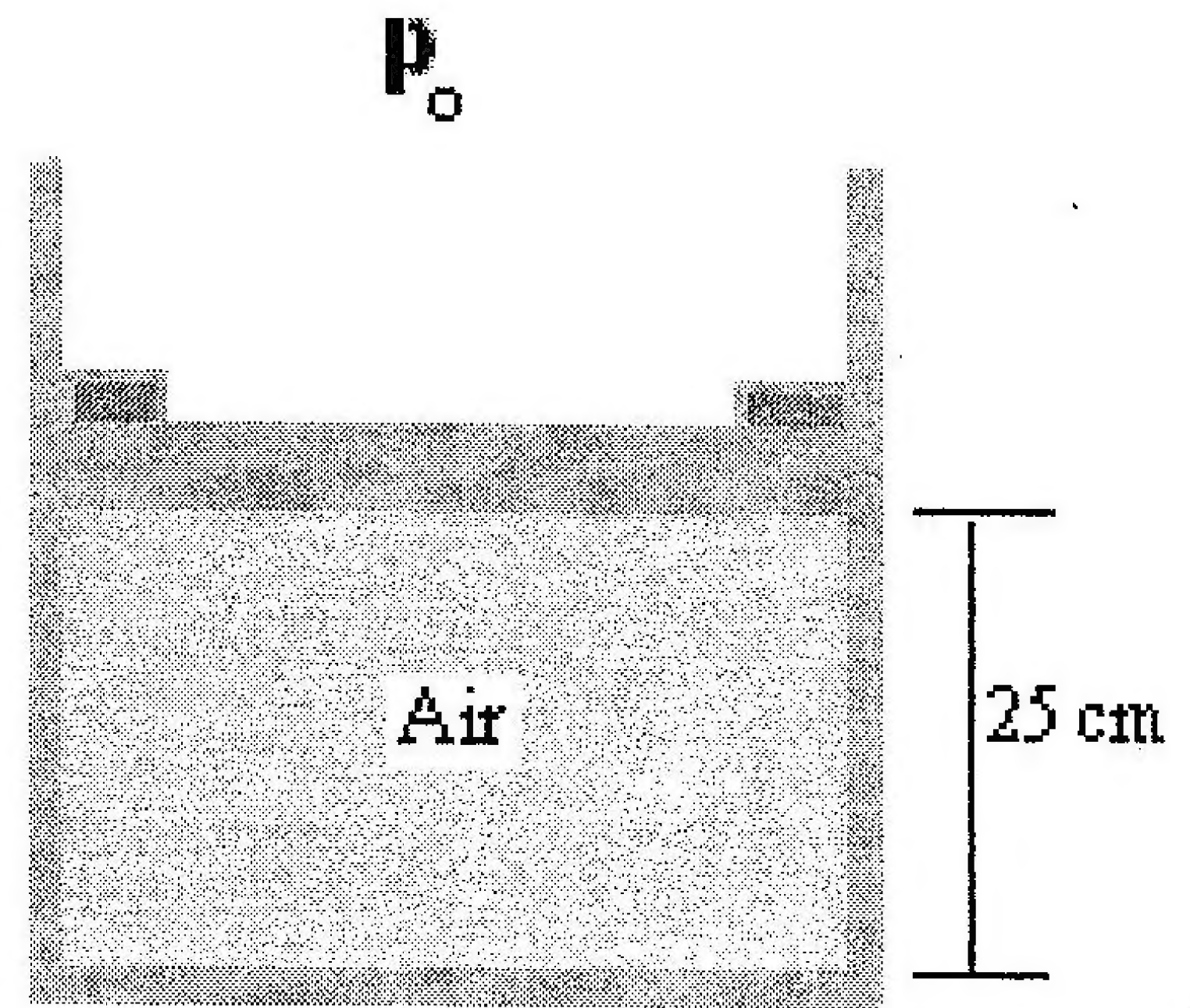
$$T = 300^\circ\text{C}$$

$$m_p = 50 \text{ kg}$$

$$D = 0.1 \text{ m}$$

$$P_o = 100 \text{ kPa}$$

$$T = 20^\circ\text{C}$$



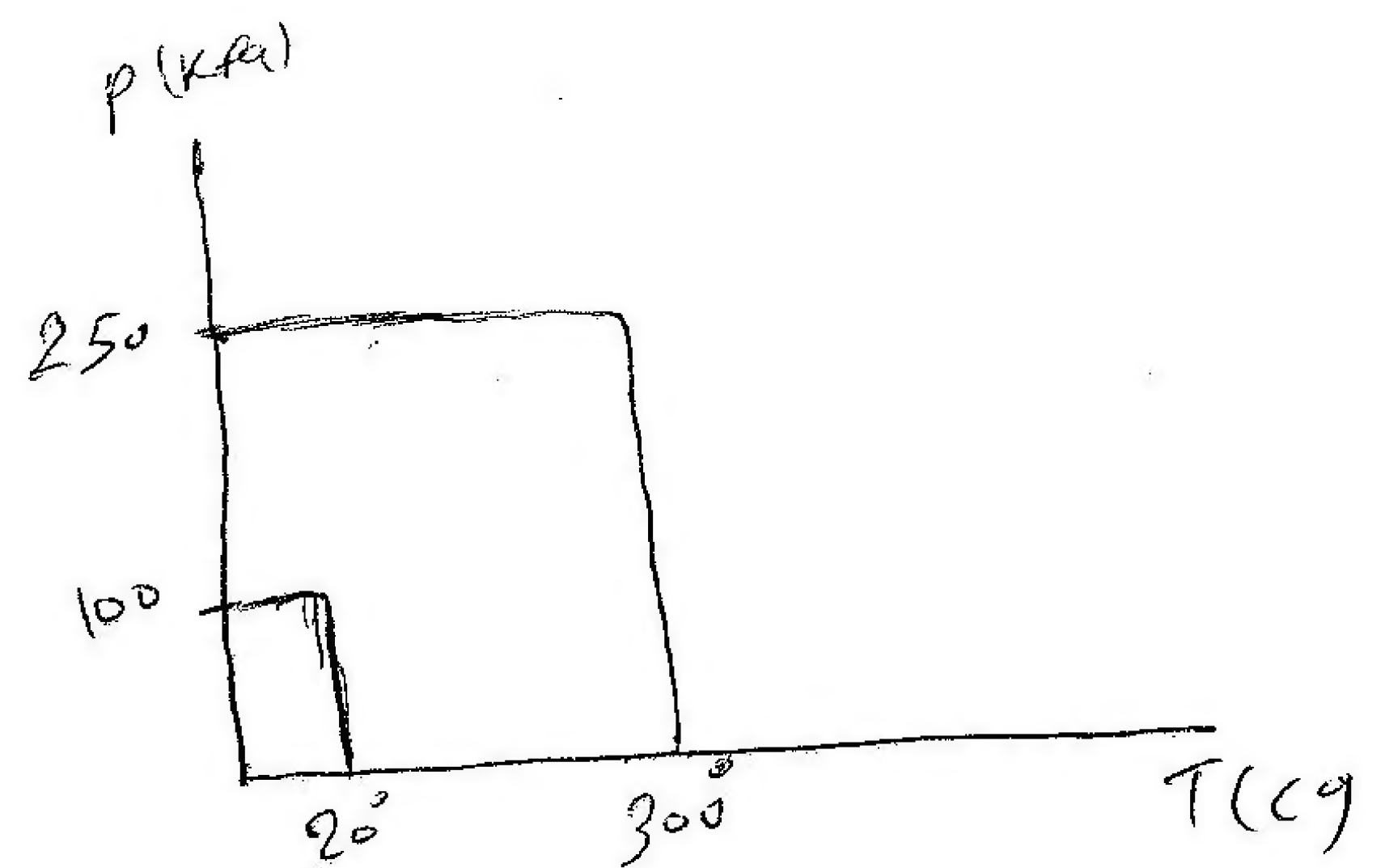
$$P \cdot A = m_p g + P_o A$$

$$\frac{250}{1000} \cdot A = 50 \cdot 9.8 + \frac{100}{1000} \cdot A$$

$$0.25A = 490 + 0.1A$$

$$0.15A = 490$$

$$A = 3266.66 \text{ m}^2$$



$$P_2 A = m_p g + P_o A$$

~~scribble~~

Good luck

3